MAG Systems Management and Operations (SMO) Plan

Task 4 Report – Regional Priorities for SMO Investments

May 2017

Prepared for:

MARICOPA ASSOCIATION of GOVERNMENTS

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ICF INTERNATIONAL

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1 INTRODUCTION

To reach the desired level of systems management and operations that is identified in the MAG Systems Management and Operations (SMO) vision and future concept, there will need to be specific investments in local and regional infrastructure, systems, and resources to support operations. A set of regional priorities, in terms of the types and locations of investments needed, will assist MAG and regional partners in programming these investments. It is intended that projects and resources that will have the most influence toward reaching the SMO vision and goals be given priority in the programming and implementation processes.

This report describes the methodology, developed with input from the SMO Technical Advisory Group (TAG), that was applied to identify a hierarchy of regionally-significant corridors in the MAG region. This report also identifies a strategy for improving regional operations and the required resources. It includes results of applying the proposed methodology and provides a list of priority facilities in the region for the existing transportation network. The priority facilities that are identified, along with other regional priority programs, will ultimately be included in the Regional Transportation Plan (RTP) and will be a driving factor in the development of the future MAG Transportation Improvement Program (TIP).

2 SYSTEMS OPERATIONS PRIORITY CATEGORIES

The MAG SMO Plan is organized around four categories of priorities for funding consideration through the RTP. The four categories include:

- **Integrated Corridor Management (ICM) Corridors** – includes all freeways in the MAG region and the adjacent arterial corridors (and crossing arterials) that provide direct support for the freeway as a detour route.
- **Regional Priority Arterials** – consists of those corridors that are identified as regionally-significant based on a data-driven assessment using crash, travel time and vehicle-miles-traveled as criteria.
- **Local Priority Corridors** – includes roadways that are identified by local agencies as priorities, but do not fall in to the ICM or Regional Priority Arterial categories. Funding should be available for local projects similar to the current TIP programming process.
- **Regional Operations Priorities** – consists of regional activities and initiatives to support operations at a regional level, including programs such as staffing for sub-regional traffic management centers (TMCs), training, Traffic Incident Management (TIM) initiatives, regional Intelligent Transportation Systems (ITS) device maintenance, regional data, performance reporting and other related activities.

There is a need to address high priority corridors in the region, and there also is a need to continue to support build out and implementation of local agency systems. MAG partner agencies also agree that there is a need to establish certain capabilities at a regional level – to promote consistency, achieve economies of scale and limit duplicative investments. The four-category approach addresses each of these needs. These four categories will be further refined in the Task 5 Implementation Strategies.

This approach for future regional investments in Systems Management and Operations was presented, during the month of April 2017, to all levels of MAG policy makers.

3 ICM AND FREEWAY PRIORITY METHODOLOGY

Integrated corridor management is a key component of the SMO Vision, and has been an important operational objective for MAG and its partner agencies for more than a decade. Establishing ICM as a priority category means that freeways and their adjacent supporting arterials need to be equipped with the capability to be operated as a coordinated corridor. The proposed ICM corridors for the region are shown in **Figure 1**. The approximately two-mile wide corridors around the freeway allow the local agency to identify the best route or routes within that corridor to serve as the adjacent arterial to support ICM.

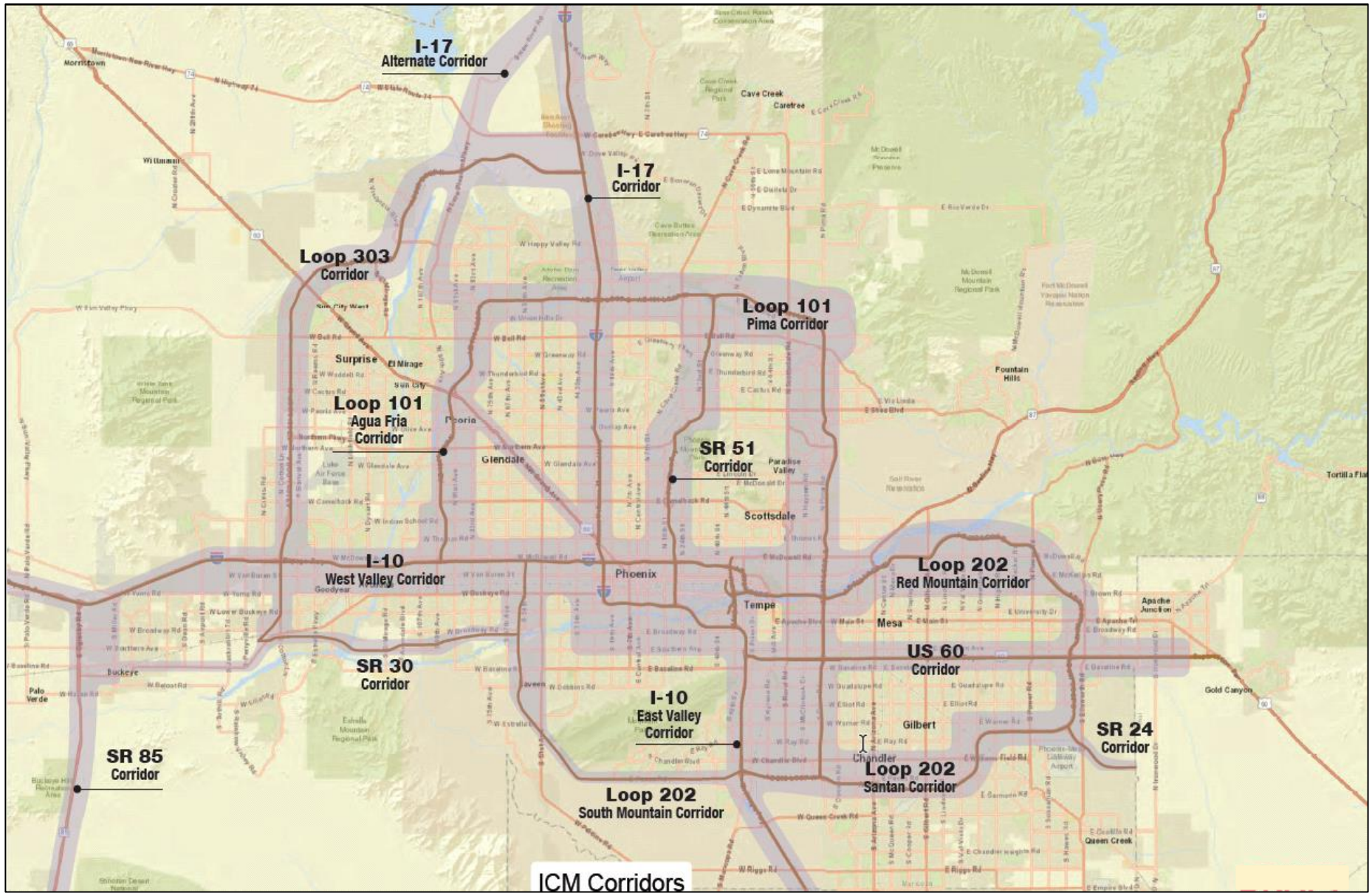


Figure 1 – Recommended ICM Corridors in the MAG Region

ADOT is the only agency responsible for operating freeways; however, priorities for funding and development of freeways are established through the MAG planning process in consultation with ADOT. It is recommended the methodology for prioritizing freeways through this SMO Plan should align with current MAG planning processes used to prioritize freeway investments. Freeway priority strategies will largely influence the Integrated Corridor Management category of SMO priorities. The intent is that any future investments in ITS and operations upgrades on a freeway segment must be accompanied by similar investments to upgrade the supporting ICM arterials. In some instances, the supporting ICM arterials, as identified in Figure 1, are located outside of the two-mile corridor. These represent the closest alternative routes for those freeway segments. It should be noted that local agencies will need to define specific alternate routes; in some cases, the closest parallel arterial might not be the most viable alternate. An example is Pima Road, which is adjacent to the Loop 101 (Pima Freeway). The City of Scottsdale's rerouting plan identifies Hayden and Scottsdale roads as preferred alternates.

For this prioritization process, only the ADOT-owned roadways that operate as freeways are considered. The ADOT-owned roads that operate as arterials (i.e., SR 87/Arizona Ave, US 60/Grand Avenue, etc.) have been accounted for during the arterial prioritization exercise.

4 REGIONAL ARTERIAL PRIORITY METHODOLOGY

The methodology to identify regionally-significant corridors needed to be data-driven and repeatable, so that future iterations with updated data would follow a similar process. Feedback from the project TAG was used to refine the process, assess impacts of different criteria or criteria weighting, and ultimately shaped the segment definition and prioritization strategies. The resulting priorities from this effort will guide regional SMO arterial investments, including allocating regional resources to build or replace necessary ITS infrastructure on priority arterials.

The arterial prioritization methodology is a four-step process that utilizes geographical information systems (GIS) and Microsoft Excel tools to: 1) identify the logical roadway segments to be evaluated; 2) evaluate each segment against prioritization criteria to get a score; 3) generate a list of the top priority arterial segments based on rank of scoring (highest to lowest); and 4) consider additional segments that should be included to create continuous priority corridors.

4.1 Identifying logical arterial roadway segments for evaluation

All roadways in the MAG planning area that function as major arterials were considered for evaluation; this included some state routes that operate as arterials, such as US 60/Grand Avenue. A list of over 500 segments was identified for evaluation as part of the SMO Plan arterial prioritization effort. Identification of the segments and their terminals was performed in a GIS environment.

Segments were generally developed to be three to six miles in length, with the goal of creating relatively uniform segments so that areas of high traffic volumes or crash occurrence were not diluted by longer portions of the segment that have lower traffic or crash history. The segment endpoints were generally determined based on where segment characteristics change significantly, and usually in response to different land uses. Initially, most segments had start or end points at freeways; the TAG noted that this did not account for the land uses near freeways that were significant traffic generators. Characteristics considered in the development of segments included: the location of major employment and activity centers; traffic volumes; average vehicle speeds during morning and afternoon peak periods; and the number of travel lanes. These were identified using regional GIS data provided by MAG. Freeway interchanges often were located to be in the middle of a segment, with the segment extending a few miles in each direction, reflecting the concentration of traffic that is present on arterials near freeway interchanges.

The result of this first step was a GIS layer, shown in **Figure 2**, that was used in a later step in conjunction with data layers to help evaluate and score each segment against specific criteria. While this segment layer was used for this evaluation, it is anticipated that it will need to be updated for future prioritization efforts to reflect changes in both

the transportation network and the land uses in the region. For example, the Loop 202 (South Mountain Freeway) is likely to have significant impacts on the roadway network and the traffic flow in the region, and the logical segments in the west valley will likely change but still need to be accounted for in the prioritization process. Continued development along the Loop 101 corridor also might necessitate some changes to how segments are defined.

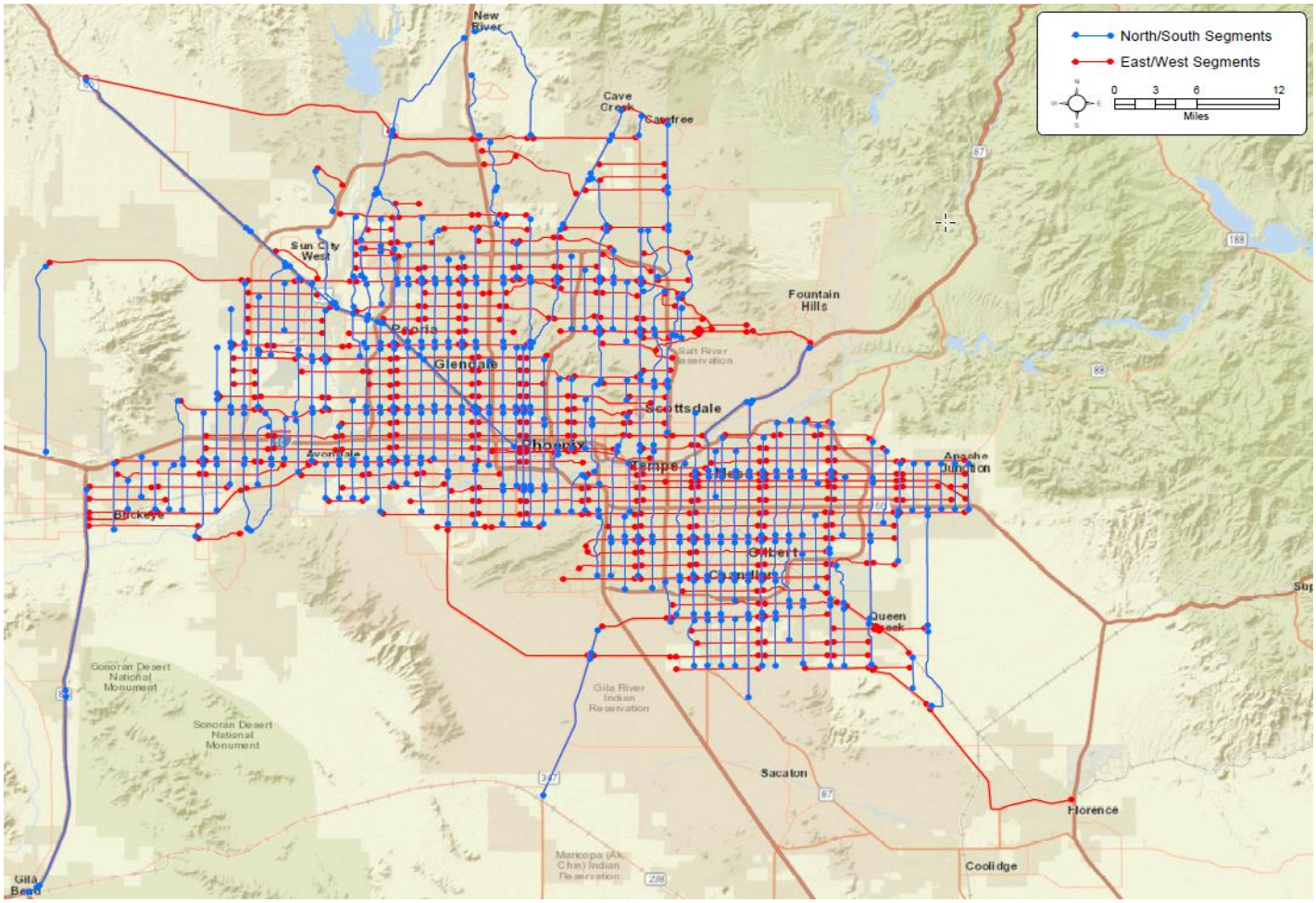


Figure 2 – Segments for SMO Prioritization Exercise

4.2 Evaluating Segments Against Prioritization Criteria

The TAG assessed several different criteria that could be used to determine priority arterials. Factors that drove the selection of arterial prioritization criteria were alignment with future vision for SMO (from Task 3), ability to demonstrate regional (as opposed to more localized) mobility, and the availability of regional-level data (i.e., data for all roadways in the region) in a format compatible with GIS.

Ultimately, three factors/metrics emerged that encapsulated the core missions of improving operations: crashes (safety and congestion), travel time (reliability), and vehicle miles traveled (mobility in relation to volumes). Each segment was evaluated based on these prioritization factors/metrics, shown in **Table 1**, which resulted in a score for each segment.

Table 1 – Arterial Prioritization Criteria

Factor Goal	Metric	Calculation	Scoring
Safety	Crashes per mile per year	Total number of crashes (all crashes) in the most recent 5-year period / segment length (miles)] / 5	Resulting number was normalized to a five-point scale
Reliability	Maximum Travel Time Index (TTI)	Maximum TTI per segment [average travel time during peak hours / travel time at free-flow conditions]	Resulting number was normalized to a five-point scale
Mobility/ Flow	Average Vehicle Miles Traveled (VMT) per mile	Weighted average VMT / segment length (miles)	Resulting number was normalized to a five-point scale

Several factors were considered and tested before reaching consensus on the final three. Examples of other factors that were considered were: average annual daily traffic (AADT), congestion (measured by average speed compared to posted speed), inclusion in the National Highway System, and intersection crash frequencies.

The first step in the evaluation was completed using GIS. Each segment was given a unique ID number. Each data point included a spatial reference so that it could be related to the segment layer in GIS, which also had a spatial reference. The layers were joined in GIS so that each data point was associated with a specific segment. The segments and their associated data was then exported into an excel table and each segment was given a 'score' in line with the calculation in Table 1. The resulting scores were reviewed for missing, erroneous or abnormal data, and then scores were then normalized to a five-point scale.

This process was repeated for each of the factors so that each arterial segment was associated with three scores, and these were added up to generate the total score for the segment.

4.3 Resulting Priorities

After total scores were generated for each segment, the list was sorted in descending order, so that the highest scoring segments were at the top. The TAG decided to use to top 100 segments as regional priority arterials and agreed that these segments represent priority arterials for facilitating regional mobility. These segments were exported back into GIS and were displayed on a map to allow for visual confirmation of the top 100 scoring segments, which is shown in **Figure 3**. The spreadsheet that was used to generate the top 100 segments and that was used to create the map in Figure 3 can be found in **Appendix A**.

This also was the step where criteria could be assigned weights to put emphasis on certain criteria over others. The TAG decided that all the criteria for this evaluation should have equal weight, as there is not one criterion that is more important than another in terms of identifying priority arterials. As such, all criteria were given the weight of 1.0 so that no scores were altered from the original scoring.

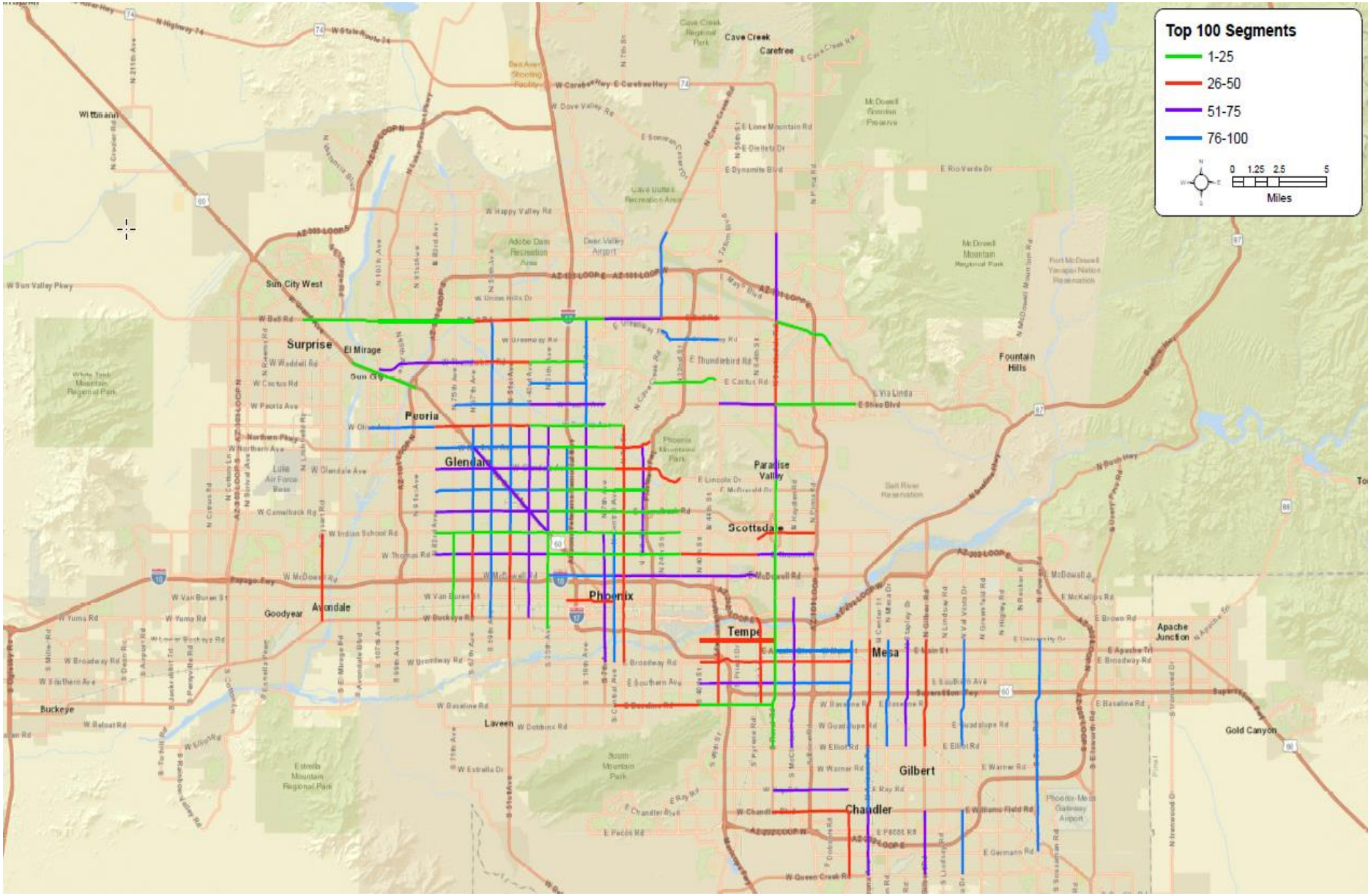


Figure 3 – Top 100 Arterial Segments Ranked Based on Score

4.4 Additional Factors Influencing Priorities

When the top 100 segments were mapped, a few gaps were identified in otherwise complete corridors. Knowing that operations cannot be conducted on a segment-by-segment basis, but instead need to be treated at the corridor-level, there was justification to add additional segments to the priority list, resulting in priority *corridors*.

Additional transportation and mobility factors also were considered in relation to the segments. These included corridors that are part of the regional freight network, and corridors that have a high priority transit route (Valley Metro Top 20 bus route based on ridership). Overlaying these additional data layers reveled a fair amount of consistency between the Top 100 routes and the priority freight and transit routes, and helped to justify closing gaps on the priority corridors. The maps showing the overlay of freight and transit factors with the top 100 segments are found in **Appendix B1 and B2**.

5 LOCAL PRIORITY ARTERIAL CORRIDORS

The TAG, as well as several key committees at MAG, strongly supported the concept of the SMO Plan having provisions that would allow funding to be allocated toward systems and arterials that were deemed local priorities. Many MAG member agencies have relied on TIP funding to implement traffic control and management systems, operations centers, enhanced signal operations, traveler information systems and equipment to support planned special events. The TAG recommended that a category be designated for local agencies to be able to submit ITS and SMO project applications, through a competitive call for projects, like how ITS project applications are submitted today.

It is envisioned that future funding for all four priority categories will be a combination of federal funds (Congestion Mitigation and Air Quality) as well as regional funds.

6 REGIONAL OPERATIONS PRIORITIES

The final priority category is one that addresses the need to support operations at the regional level. Several SMO functions will need to be seamless across jurisdictional boundaries. Functions such as the Freeway Service Patrol (FSP), colocation of Department of Public Safety (DPS) officers in the ADOT TOC, regional data and some traveler information functions are handled by ADOT, MAG, Valley Metro and Maricopa County. There is a need to continue to look for ways that regional SMO needs can be delivered with a regional strategy.

Examples of regional strategies are envisioned to include:

- Operating sub-regional TMCs – there is a need to provide support after business hours for major incidents impacting ICM or priority arterials. This strategy will focus resources toward staff, integration, equipment and training to allow for some operations strategies to be handled at the sub-regional level. One option is to upgrade a small number (three or four) of existing local TMCs to serve in a sub-regional TMC role with resources for staffing, training and equipment capabilities. A second option is to explore capabilities of a virtual TMC that can interface with agency signal systems and allow for remote operations of traffic signals and ITS equipment.
- Real-time data for regional operations – this strategy could expand availability and use of real-time data on the arterial network throughout the Valley.
- Regional ITS/SMO maintenance – the TAG identified this as a potential need. Presently, each agency needs to have the technical expertise on-staff to address maintenance needs. There could be a benefit to centralizing some aspects of ITS/SMO maintenance.
- Support Traffic Incident Management initiatives – this strategy would support TIM programs and activities, such as local agency TIM training, regional TIM performance tracking, expanded FSP, and others.

Specific regional operations priorities will be defined in Task 5.

7 REVIEWING AND UPDATING THE PRIORITY SEGMENTS

7.1 Process to Update Priorities

The list of arterial segments shown in Figure 2 and Appendix A emerged as the top 100 based on data that is currently available, and based on the existing roadway configuration within the MAG region. As the region grows in population and size and as new freeways and roadways are added, the regional priorities also are likely to change. Since the SMO Plan and the current RTP have a 2040 outlook, it is recommended that the list of the top 100 arterials should be reviewed and if necessary updated prior to each TIP programming cycle.

The prioritization methodology that was developed in this task was designed to be data-driven and repeatable; MAG can replicate or update the top 100 list when updated data becomes available. All the data used for this process is either generated or made available by MAG, except for transit ridership, which is publicly available through Valley Metro. Additionally, the analysis and evaluation was completed in GIS and Microsoft Excel, which are widely used and available at MAG and other agencies in the region, thus avoiding any restrictions that could have arisen from the need for specialized software. In a future project task, the prioritization methodology will be documented in detail.

Some questions have been asked about the accuracy of some data sets available, and this creates challenges in a process that relies on accurate data. There will need to be a data strategy put into place to make sure that accurate and complete data are available for the three criteria identified in Table 1 going forward. A consideration for this strategy should include the procurement of private sector data to address challenges with data availability. Additional recommendations related to a data strategy will be included in the Implementation report for this project (Task 5).

7.2 Data Sources Used

Available data from a variety of databases and sources were used to evaluate corridors. This data is available from MAG and Valley Metro. Key data sources and types used for this assessment include:

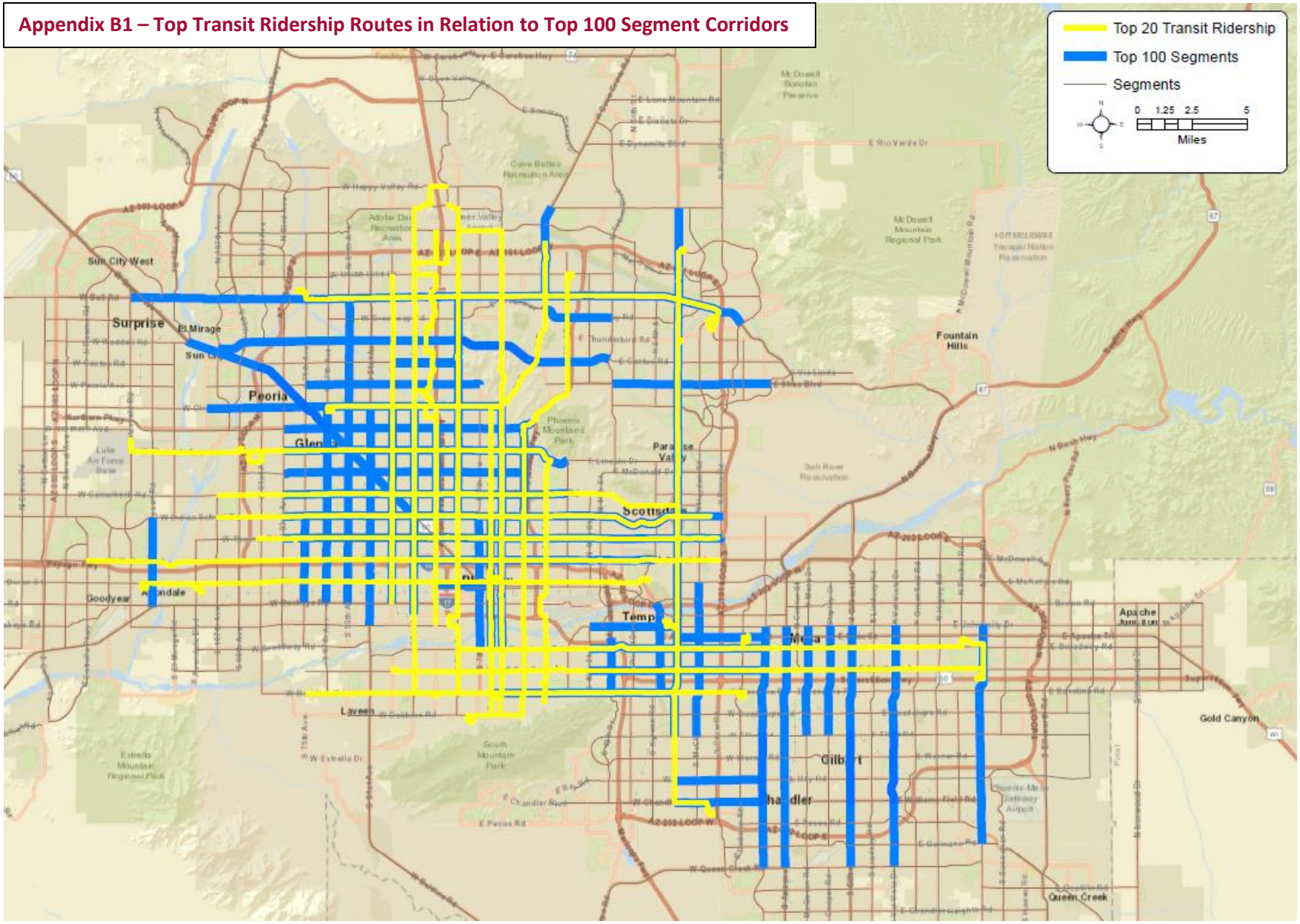
- Vehicle Miles Traveled from MAG regional model 2020
- Travel Time Index data from the MAG performance dashboard 2014 (http://performance.azmag.gov/)
- Crashes from MAG crash database 2011-2015
- Transit ridership from Valley Metro 2016
- Freight routes from the MAG Draft Freight Network 2017

Appendix A – Resulting Top 100 Segments

RANK	STREET NAME	FROM	TO	ID	CRASHES/MILE/YEAR (normalized to 5-point scale)	MAXIMUM TRAVEL TIME INDEX (normalized to 5-point	WEIGHTED AVERAGE VEHICLE MILES TRAVELED/MILE	TOTAL
				Weight for Criteria	1.0	1.0	1.0	
1	Camelback Rd	Central	35th Ave	294	4.40	3.56	5.00	12.96
2	Camelback Rd	32nd St	Central	293	4.11	3.48	4.22	11.80
3	Baseline Rd	Rural	40th St	441	5.00	3.44	3.32	11.76
4	Indian School Rd	Central	35th Ave	100	4.27	3.16	4.11	11.55
5	Bell Rd	67th Ave	Del Webb	213	4.30	3.12	4.09	11.51
6	Indian School Rd	32nd St	Central	305	4.47	3.35	3.12	10.94
7	Bethany Home Rd	Central	35th Ave	284	3.68	2.94	3.67	10.28
8	Northern Ave	Central	35th Ave	35	3.57	2.64	3.73	9.94
9	Grand Ave	91st Ave	Thompson Ranch	5	2.80	3.06	3.91	9.76
10	Bell Rd	Del Webb	Litchfield	96	2.08	2.93	4.46	9.47
11	Glendale Ave	Central	35th Ave	278	3.29	2.66	3.51	9.47
12	Thomas Rd	Central	35th Ave	145	3.64	2.94	2.67	9.25
13	Indian School Rd	35th Ave	83rd Ave	119	4.19	2.20	2.70	9.09
14	Thomas Rd	32nd St	Central	302	3.58	2.83	2.58	8.99
15	Scottsdale-Rural	Elliot	McKellips	67	4.12	1.97	2.85	8.94
16	Bethany Home Rd	SR 51	Central	277	2.54	2.67	3.61	8.82
17	Bell Rd	Thompson Peak	Scottsdale	41	2.59	2.80	3.28	8.67
18	Scottsdale Rd	McKellips	Lincoln	101	2.79	2.82	3.04	8.65
19	Cactus Rd	Tatum	Cave Creek	245	2.32	2.64	3.67	8.63
20	Bell Rd	7th Ave	43rd Ave	30	2.92	2.77	2.86	8.56
21	35th Ave	Durango	Indian School	47	3.04	3.15	2.30	8.49
22	Dunlap Ave	7th St	43rd Ave	250	2.36	2.72	3.40	8.48
23	Shea Blvd	Via Linda	Scottsdale	44	2.66	2.47	3.32	8.46
24	Thunderbird Rd	19th Ave	43rd Ave	237	2.71	2.64	3.09	8.44
25	75th Ave	Buckeye	Indian School	1	3.18	3.23	2.02	8.42
26	Country Club-Arizona Ave	Elliot	University	23	2.69	2.53	3.18	8.40
27	51st Ave	Lower Buckeye	Indian School	24	3.03	3.28	2.10	8.40
28	Chandler Blvd	Alma School	Rural	478	2.65	2.74	3.01	8.40
29	Gilbert Rd	Elliot	University	394	2.63	2.52	3.13	8.28
30	67th Ave	Buckeye	Indian School	28	3.26	2.98	1.98	8.22
31	University Dr	Rural	40th St	64	3.11	2.89	2.15	8.14
32	Washington St	Central	27th Ave	359	3.80	3.22	1.09	8.11
33	Bell Rd	Tatum	Cave Creek	193	2.96	2.54	2.58	8.08
34	Thomas Rd	64th St	32nd St	321	3.07	2.28	2.72	8.07
35	Dysart Rd	MC 85	Indian School	316	2.53	2.90	2.58	8.02
36	48th St	Baseline	I-10	345	2.67	2.87	2.48	8.02
37	Mill Ave	Baseline	Curry	66	3.12	2.78	2.10	8.00
38	Broadway Rd	Alma School	Rural	65	2.90	2.55	2.54	7.98
39	Baseline Rd	40th St	Central	103	2.67	2.49	2.83	7.98
40	Bell Rd	43rd Ave	67th Ave	205	3.03	2.18	2.71	7.93
41	Olive Ave	43rd Ave	83rd Ave	122	3.21	2.04	2.62	7.88
42	Glendale-Lincoln	32nd St	Central	45	2.03	2.31	3.53	7.87
43	Indian School Rd	Loop 101E	64th St	308	2.45	2.54	2.87	7.87
44	Alma School Rd	Queen Creek	Chandler	479	2.87	2.69	2.30	7.87
45	Broadway Rd	Rural	40th St	411	2.89	2.69	2.27	7.85
46	Northern Ave	SR 51	Central	270	2.34	2.27	3.23	7.84
47	Scottsdale Rd	Shea	Frank Lloyd Wright	217	2.20	2.77	2.85	7.81
48	7th St	Indian School	Dunlap	39	3.41	1.99	2.41	7.81
49	Thunderbird Rd	43rd Ave	67th Ave	238	3.06	2.19	2.51	7.75
50	7th St	Broadway	Indian School	55	2.80	2.48	2.46	7.74

RANK	STREET NAME	FROM	TO	ID	CRASHES/MILE/YEAR (normalized to 5-point scale)	MAXIMUM TRAVEL TIME INDEX (normalized to 5-point	WEIGHTED AVERAGE VEHICLE MILES TRAVELED/MILE	TOTAL
				Weight for Criteria	1.0	1.0	1.0	
50	7th St	Broadway	Indian School	55	2.80	2.48	2.46	7.74
51	Arizona Ave	Queen Creek	Chandler	477	2.45	2.53	2.72	7.70
52	McDowell Rd	64th St	32nd St	339	2.86	1.64	3.17	7.67
53	Cooper-Stapley	Elliot	University	397	2.54	2.75	2.36	7.66
54	Camelback Rd	35th Ave	83rd Ave	136	2.97	2.29	2.34	7.60
55	Scottsdale Rd	Frank Lloyd Wright	Pinnacle Peak	152	1.49	2.94	3.13	7.56
56	Peoria Ave	7th Ave	43rd Ave	34	2.40	2.84	2.31	7.54
57	Glendale Ave	35th Ave	83rd Ave	128	2.83	2.17	2.53	7.53
58	Gilbert Rd	Queen Creek	Chandler	109	2.00	2.60	2.86	7.47
59	Thomas Rd	35th Ave	83rd Ave	320	3.10	1.72	2.65	7.47
60	Thomas Rd	Loop 101E	64th St	322	2.62	2.34	2.42	7.37
61	Bell Rd	Cave Creek	7th Ave	191	2.55	2.37	2.45	7.37
62	Shea Blvd	Scottsdale	Tatum	251	1.63	2.39	3.32	7.34
63	35th Ave	Indian School	Dunlap	204	3.07	1.83	2.43	7.34
64	Ray Rd	Alma School	Rural	471	2.04	2.36	2.93	7.32
65	Thunderbird Rd	67th Ave	103rd Ave	240	1.92	2.66	2.74	7.32
66	McDowell Rd	32nd St	Central	323	2.72	2.60	1.99	7.31
67	19th Ave	Indian School	Dunlap	261	2.09	2.82	2.39	7.30
68	43rd Ave	Buckeye	Indian School	27	2.60	2.51	2.15	7.26
69	Grand Ave	35th Ave	67th Ave	120	1.52	1.86	3.76	7.13
70	43rd Ave	Indian School	Olive-Dunlap	43	2.84	1.87	2.40	7.11
71	7th Ave	Broadway	Indian School	52	2.68	2.15	2.26	7.10
72	16th St	Thomas	Northern	269	2.47	2.45	2.16	7.08
73	Southern Ave	Rural	40th St	431	2.59	2.27	2.23	7.08
74	McClintock Dr	Elliot	McKellips	356	2.48	2.35	2.25	7.08
75	Scottsdale Rd	Lincoln	Shea	254	1.53	2.42	3.04	7.00
76	Alma School Rd	Elliot	University	94	2.08	2.33	2.59	7.00
77	Val Vista Dr	Elliot	University	391	2.03	2.37	2.59	6.99
78	59th Ave	Buckeye	Indian School	303	2.09	2.60	2.30	6.99
79	Central Ave	Broadway	Indian School	309	2.16	2.94	1.85	6.95
80	59th Ave	Indian School	Olive	132	2.75	1.94	2.23	6.91
81	Arizona Ave	Chandler	Elliot	459	2.47	1.83	2.58	6.89
82	Cave Creek Rd	Bell Rd	Pinnacle Peak	151	1.95	2.45	2.48	6.88
83	McQueen-Mesa	Elliot	University	398	1.86	2.04	2.97	6.87
84	Apache-Main	Alma School	Rural	58	1.80	2.56	2.51	6.86
85	19th Ave	Dunlap	Bell	201	2.41	2.13	2.30	6.84
86	51st Ave	Indian School	Olive	37	2.41	2.16	2.25	6.82
87	Bethany Home Rd	35th Ave	83rd Ave	20	2.74	1.75	2.31	6.80
88	Greenway Rd	Tatum	7th Ave	220	2.38	1.72	2.69	6.79
89	Northern Ave	35th Ave	83rd Ave	125	2.46	1.95	2.37	6.79
90	Val Vista Dr	Queen Creek	Williams Field	83	1.61	2.56	2.60	6.76
91	Peoria Ave	43rd	75th Ave	255	2.57	1.82	2.35	6.74
92	Power Rd	Germann	Warner	466	1.12	2.36	3.26	6.74
93	67th Ave	Indian School	Olive	126	2.63	1.99	2.04	6.66
94	Cactus Rd	19th Ave	43rd Ave	36	2.02	2.08	2.55	6.66
95	Olive Ave	83rd Ave	111th Ave	265	2.02	2.28	2.33	6.63
96	Southern Ave	Alma School	Rural	78	2.36	2.27	1.99	6.63
97	McDowell Rd	Central	35th Ave	336	2.90	2.03	1.69	6.62
98	59th Ave	Olive	Bell	211	2.71	1.65	2.25	6.61
99	Power Rd	University	Warner	387	1.76	2.20	2.63	6.60
100	27th Ave	Indian School	Northern	271	2.70	1.95	1.89	6.55

Appendix B1 – Top Transit Ridership Routes in Relation to Top 100 Segment Corridors



Appendix B2 – Regional Freight Network in Relation to Top 100 Segments